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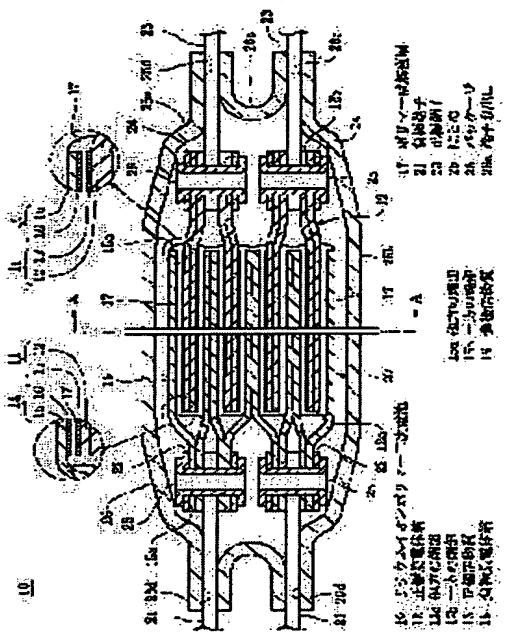
(54) LITHIUM ION POLYMER SECONDARY BATTERY

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a necessary cross-sectional area of a terminal corresponding to a discharge capacity, and reduce a resistance at a terminal junction part while securing flexible properties.
SOLUTION: One end parts 12b of plural positive electrode current collector foils are divided into plural pairs in laminated sequences, respective one ends of plural positive electrode terminals 23 corresponding to the number of the pairs are inserted between the one end parts 12b of the positive electrode collector foils laminated on a pair-by-pair basis to be connected with the one end parts 12b, other end parts 15a of plural negative electrode current collector foils 15 are divided into plural pairs in laminated sequences, respective one ends of the plural negative electrode terminals 21 corresponding to the number of the pairs are inserted between the other end parts 15a of the negative electrode current collector foils laminated on the pair-by-pair basis to be connected with the other end parts 15a, and a package 26 has terminal drawing out ports 26d enabling to separately take out respective other ends of the plural positive electrode terminals 23 and respective other ends of the plural negative electrode terminals 21, wherein the respective other ends of the plural positive electrode terminals 23 and the respective other ends of the plural negative electrode terminals 21 are constituted so as to be respectively laminated and capable of being adhered.



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[Claim(s)]

[Claim 1] Positive active material (13) is applied to each front face of two or more positive-electrode charge collector foils (12). A negative-electrode active material (16) is applied to each front face of two or more negative-electrode charge collector foils (15). The laminating of two or more of said positive-electrode charge collector foil (12) and said two or more negative-electrode charge collector foils (15) is carried out through a polymer electrolyte layer (17), respectively between said positive active material (13) and said negative-electrode active materials (16). The end of a sheet-like positive-electrode terminal (23) is connected to one [all] edge (12b) of two or more of said positive-electrode charge collector foils (12) which project from one edge (15b) of said negative-electrode charge collector foil (15). The end of a sheet-like negative-electrode terminal (21) is connected to all the other-end sections (15a) of two or more of said negative-electrode charge collector foils (15) which project from the other-end section (12a) of said positive-electrode charge collector foil (12). In the lithium ion polymer rechargeable battery by which (20) of said positive-electrode charge collector foil (12) and said negative-electrode charge collector foil (15) was sealed with a package (26) so that the other end of said positive-electrode terminal (23) and the other end of said negative-electrode terminal (21) might be expressed One edge (12b) of two or more of said positive-electrode charge collector foils (12) is divided into two or more sets in order of a laminating. One edge each of two or more positive-electrode terminals (23) which responded to said number of groups is inserted between one edges (12b) of said positive-electrode charge collector foil by which the laminating was carried out for every group, and is connected to one edge (12b) of said positive-electrode charge collector foil. The other-end section (15a) of two or more of said negative-electrode charge collector foils (15) is divided into two or more sets in order of a laminating. One edge each of two or more negative-electrode terminals (21) which responded to said number of groups is inserted between the other-end sections (15a) of said negative-electrode charge collector foil by which the laminating was carried out for every group, and is connected to the other-end section (15a) of said negative-electrode charge collector foil. It has terminal output port (26d) of the number according to said number of groups as which said package (26) can express each other end of two or more of said positive-electrode terminals (23), and each other end of two or more of said negative-electrode terminals (21) according to an individual. And the lithium ion polymer rechargeable battery with which the laminating of each other end of each other end of two or more of said positive-electrode terminals (23) and two or more of said negative-electrode terminals (21) was carried out, respectively, and it was constituted possible [adhesion].

[Claim 2] The lithium ion polymer rechargeable battery according to claim 1 two or more positive-electrode terminal (23) and two or more negative-electrode terminals (21) of whose are an expanded metal or the punched metal sheet, respectively.

[Claim 3] Between one edges (12b) of the positive-electrode charge collector foil (12) with which the laminating of the one edge each of two or more positive-electrode terminals (23) was carried out for every group One edge each of said positive-electrode terminal (23) is connected to one edge (12b) of two or more of said positive-electrode charge collector foils (12) by two or more closed eyes a pigeon (25). spacing (t) predetermined to the direction which intersects the path of insertion in the condition of having been inserted -- opening -- Between the other-end sections (15a) of the negative-electrode charge collector foil (15) with which the laminating of the one edge each of two or more negative-electrode terminals (21) was carried out for every group spacing (t) predetermined to the direction which intersects the path of insertion in the condition of having been inserted -- opening -- by two or more closed eyes a pigeon (25) The lithium ion polymer rechargeable battery according to claim 1 or 2 by which one edge each of said negative-electrode terminal (21) was connected to the other-end section (15a) of two or more of said negative-electrode charge collector foils (15).

[Claim 4] The construction material of a positive-electrode charge collector foil (12) Or the reinforcement foil or reinforcement sheet metal (22 24) which is the same construction material as the construction material of a negative-electrode charge collector foil (15), and has the thickness of 0.05-0.5mm is arranged on each outside surface by which the laminating was carried out for every group of the edge of either said positive-electrode charge collector foil (12) or said negative-electrode charge collector foil (15) and both sides. The lithium ion polymer rechargeable battery according to claim 3 to which or was closed for two or more eyes a pigeon (25) through said reinforcement foil or reinforcement sheet metal (22 24), respectively.

[Claim 5] Between one edges of said positive-electrode charge collector foil (12) with which the laminating of the one edge each of two or more positive-electrode terminals (23) was carried out for every group One edge each of said positive-electrode terminal (23) is connected to one edge (12b) of two or more of said positive-electrode charge collector foils (12) by opening and carrying out two or more place ultrasonic welding of the predetermined spacing (t) in the direction which intersects the path of insertion in the condition of having been inserted. Between the other-end sections (15a) of said negative-electrode charge collector foil (15) with which the laminating of the one edge each of two or more negative-electrode terminals (21) was carried out for every group By opening and carrying out two or more place ultrasonic welding of the predetermined

spacing (t) in the direction which intersects the path of insertion in the condition of having been inserted The lithium ion polymer rechargeable battery according to claim 1 or 2 by which one edge each of said negative-electrode terminal (21) was connected to the other-end section (15a) of two or more of said negative-electrode charge collector foils (15).

[Claim 6] The construction material of a positive-electrode charge collector foil (12) Or the reinforcement foil or reinforcement sheet metal (22 24) which is the same construction material as the construction material of a negative-electrode charge collector foil (15), and has the thickness of 0.05-0.5mm is arranged on each outside surface by which the laminating was carried out for every group of the edge of either said positive-electrode charge collector foil (12) or said negative-electrode charge collector foil (15) and both sides. The lithium ion polymer rechargeable battery according to claim 5 by which ultrasonic welding was carried out through said reinforcement foil or reinforcement sheet metal (22 24).

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the lithium ion polymer rechargeable battery which carried out the laminating of positive active material and the negative-electrode active material through the polymer electrolyte layer.

[0002]

[Description of the Prior Art] Conventionally, the need over a thin and to some extent flexible cell is increasing by the spread of portable devices, such as a video camera and a notebook sized personal computer. The lithium ion polymer rechargeable battery formed as this thin cell by carrying out the laminating of a positive-electrode sheet and the negative-electrode sheet is known. This positive-electrode sheet is made by applying an active material to the front face of a positive-electrode charge collector foil, and a negative-electrode sheet is made by applying an active material to the front face of a negative-electrode charge collector foil. A polymer electrolyte layer is infixed between the active material of a positive-electrode sheet, and the active material of a negative-electrode sheet. By this cell, the positive-electrode terminal and negative-electrode terminal for taking out the potential difference in each active material as a current are prepared in a positive-electrode charge collector foil and a negative-electrode charge collector foil, and a lithium ion polymer rechargeable battery is created by sealing with a package the layered product by which the laminating was carried out in this way. In this lithium ion polymer rechargeable battery, the desired electrical and electric equipment is obtained by using the positive-electrode terminal and negative-electrode terminal which were pulled out from the package as a terminal of a cell.

[0003] Moreover, in recent years, the discharge capacity is expanded by folding up the positive-electrode sheet and negative-electrode sheet which are in the inclination to increase the discharge capacity of a lithium ion polymer rechargeable battery, carried out the laminating using the positive-electrode sheet of two or more sheets, and the negative-electrode sheet of two or more sheets, the discharge capacity was increased, or were made to expand the area of a single positive-electrode sheet and a single negative-electrode sheet, and were expanded in desired magnitude. or [, using a positive-electrode sheet and two or more negative-electrode sheets on the other hand] -- or it is required to connect mutually the edge of the positive-electrode charge collector foil of two or more sheets pulled out in the shape of a layer and a negative-electrode charge collector foil in connection with folding up and expanding discharge capacity, and to connect a positive-electrode terminal and a negative-electrode terminal. The

rechargeable battery which faces across this tied edge with the conductor which separates the edge of the positive-electrode charge collector foil of two or more sheets pulled out in the shape of a layer and a negative-electrode charge collector foil as this connecting means, and serves as a terminal in a bundle, welds the edge and conductor which were bundled, and took out the electrical and electric equipment through that conductor is proposed (JP,7-263029,A).

[0004]

[Problem(s) to be Solved by the Invention] However, when all the edges and conductors of the bundled positive-electrode charge collector foil or a negative-electrode charge collector foil are joined by welding, the mechanical strength in a part for the joint increases by welding, and there is nonconformity the flexible nature of a cell is lost. In order to secure the cross section of the terminal according to the discharge capacity increased especially, when the conductor with which the cross section of a terminal consists of a metal piece of the shape of a comparatively big rod is used, there is flexibility in a part for the joint or a fault lost thoroughly. On the contrary, also although the flexible nature of a cell can be maintained when it inserts with the conductor which has flexibility comparatively and the conductor and the governed edge are welded selectively While it becomes difficult to obtain the need cross section of the terminal according to the increased discharge capacity A clearance is generated between edges other than the part welded by incurvating a cell, and the conductor inserted from the outside, the conductivity in the part is lost, and there is a problem which resistance increases as a result and cannot obtain sufficient power. The object of this invention is to offer the lithium ion polymer rechargeable battery which can obtain comparatively easily the need cross-sectional area of the terminal according to discharge capacity. Another object of this invention is to offer the lithium ion polymer rechargeable battery which can reduce the resistance in a terminal joint, securing flexible nature.

[0005]

[Means for Solving the Problem] As invention concerning claim 1 is shown in drawing 1 and drawing 2 , positive active material 13 is applied to each front face of two or more positive-electrode charge collector foils 12. The negative-electrode active material 16 is applied to each front face of two or more negative-electrode charge collector foils 15, and the laminating of two or more positive-electrode charge collector foils 12 and two or more negative-electrode charge collector foils 15 is carried out through the polymer electrolyte layer 17, respectively between positive active material 13 and the negative-electrode active material 16. The end of the sheet-like positive-electrode terminal 23 is connected to one [all] edge 12b of two or more positive-electrode charge

collector foils 12 which project from one edge 15b of the negative-electrode charge collector foil 15. The end of the sheet-like negative-electrode terminal 21 is connected to all other-end section 15a of two or more negative-electrode charge collector foils 15 which project from other-end section 12a of the positive-electrode charge collector foil 12. As the other end of the positive-electrode terminal 23 and the other end of the negative-electrode terminal 21 are expressed, the layered product 20 of the positive-electrode charge collector foil 12 and the negative-electrode charge collector foil 15 is amelioration of the lithium ion polymer rechargeable battery sealed with a package 26.

[0006] As for the characteristic configuration, one edge 12b of two or more positive-electrode charge collector foils 12 is divided into two or more sets in order of a laminating. One edge each of two or more positive-electrode terminals 23 which responded to the number of groups is inserted between one edge 12b of the positive-electrode charge collector foil by which the laminating was carried out for every group, and is connected to one edge 12b of a positive-electrode charge collector foil. Other-end section 15a of two or more negative-electrode charge collector foils 15 is divided into two or more sets in order of a laminating. One edge each of two or more negative-electrode terminals 21 which responded to the number of groups is inserted between other-end section 15a of the negative-electrode charge collector foil by which the laminating was carried out for every group, and is connected to other-end section 15a of a negative-electrode charge collector foil. It has 26d of terminal output port of the number according to the number of groups as which a package 26 can express each other end of two or more positive-electrode terminals 23, and each other end of two or more negative-electrode terminals 21 according to an individual. And it is in the place where the laminating of each other end of each other end of two or more positive-electrode terminals 23 and two or more negative-electrode terminals 21 was carried out at, respectively, and it was constituted possible [adhesion].

[0007] In invention concerning this claim 1, only by making the number of terminals 21 and 23 increase, it becomes possible to expand that cross section, and the cross section of the terminal according to the increased discharge capacity can be obtained comparatively easily. Moreover, the rechargeable battery which is comparatively easy to incurvate as compared with the case where the comparatively thick single terminal of thickness is connected can be obtained. Moreover, since the end of the positive-electrode terminal 23 is inserted between other-end section 15a to which it was inserted between edge 12b and the laminating of while the laminating was carried out for every group of two or more positive-electrode charge collector foils 12 was carried out for every group of

the negative-electrode charge collector foil 15 of plurality [end / of the negative-electrode terminal 21] Even if it repeats a rechargeable battery 10 and incurvates it, between the positive-electrode charge collector foils 12 the positive-electrode terminal 23 and whose positive-electrode terminal 23 of its are pinched Or a clearance is not generated between the negative-electrode charge collector foils 15 the negative-electrode terminal 21 and whose negative-electrode terminal 21 of its are pinched, and the conductivity in the contact part is secured and can fully reduce the resistance in a terminal joint.

[0008] Invention concerning claim 2 is a lithium ion polymer rechargeable battery two or more positive-electrode terminal 23 and two or more negative-electrode terminals 21 of whose it is invention concerning claim 1 and are an expanded metal or the punched metal sheet, respectively. In invention concerning this claim 2, while securing the flexible nature of the sheet-like rechargeable battery 10 certainly by securing the flexibility of a terminal 21 and 23 the very thing, adhesion with a package 26 can be raised and the sealing performance of the rechargeable battery by that package 26 can be secured.

[0009] Invention concerning claim 3 is invention concerning claim 1 or 2. Between one edge 12b of the positive-electrode charge collector foil 12 with which the laminating of the one edge each of two or more positive-electrode terminals 23 was carried out for every group One edge each of the positive-electrode terminal 23 is connected to one edge 12b of two or more positive-electrode charge collector foils 12 by two or more closed eyes 25 a pigeon. the spacing t predetermined to the direction which intersects the path of insertion in the condition of having been inserted -- opening -- Between other-end section 15a of the negative-electrode charge collector foil 15 with which the laminating of the one edge each of two or more negative-electrode terminals 21 was carried out for every group the spacing t predetermined to the direction which intersects the path of insertion in the condition of having been inserted -- opening -- it is the lithium ion polymer rechargeable battery with which one edge each of the negative-electrode terminal 21 was connected to other-end section 15a of two or more negative-electrode charge collector foils 15 by two or more closed eyes 25 a pigeon.

[0010] Invention concerning claim 5 is invention concerning claim 1 or 2. Between one edge 12b of the positive-electrode charge collector foil 12 with which the laminating of the one edge each of two or more positive-electrode terminals 23 was carried out for every group One edge each of the positive-electrode terminal 23 is connected to one edge 12b of two or more positive-electrode charge collector foils 12 by opening and carrying out two or more place ultrasonic welding of the predetermined spacing t in the direction

which intersects the path of insertion in the condition of having been inserted. Between other-end section 15a of the negative-electrode charge collector foil 15 with which the laminating of the one edge each of two or more negative-electrode terminals 21 was carried out for every group One edge each of the negative-electrode terminal 21 is the lithium ion polymer rechargeable battery connected to other-end section 15a of two or more negative-electrode charge collector foils 15 by opening and carrying out two or more place ultrasonic welding of the predetermined spacing t in the direction which intersects the path of insertion in the condition of having been inserted.

[0011] Although the laminating of one edge 12b of two or more positive-electrode charge collector foils 12 and the other-end section 15a of two or more negative-electrode charge collector foils 15 is carried out for every group, respectively and the positive-electrode terminal 23 and the negative-electrode terminal 21 according to that number of groups are connected in invention concerning this claim 3 and claim 5 the connection -- the predetermined spacing t -- opening -- two or more closed eyes 25 a pigeon -- or, since it is carried out by carrying out two or more place ultrasonic welding Lifting of a mechanical strength can be controlled as compared with the case where all the parts of the edges 12a and 15b by which the laminating was carried out are joined, and the flexible nature which the sheet-like rechargeable battery 10 has from the former can be secured.

[0012] Invention concerning claim 4 is invention concerning claim 3. The reinforcement foil or the reinforcement sheet metal 22 and 24 which is the same construction material as the construction material of the positive-electrode charge collector foil 12 or the construction material of the negative-electrode charge collector foil 15, and has the thickness of 0.05-0.5mm is arranged on each outside surface by which the laminating was carried out for every group of the edge of either the positive-electrode charge collector foil 12 or the negative-electrode charge collector foil 15 and both sides. It is the lithium ion polymer rechargeable battery to which or was closed for two or more eyes 25 a pigeon through a reinforcement foil or reinforcement sheet metal 22 and 24, respectively. Invention concerning claim 6 is invention concerning claim 5. The reinforcement foil or the reinforcement sheet metal 22 and 24 which is the same construction material as the construction material of the positive-electrode charge collector foil 12 or the construction material of the negative-electrode charge collector foil 15, and has the thickness of 0.05-0.5mm is arranged on each outside surface by which the laminating was carried out for every group of the edge of either the positive-electrode charge collector foil 12 or the negative-electrode charge collector foil 15 and both sides. It is the lithium ion polymer rechargeable battery by which ultrasonic welding was carried out through a reinforcement foil or reinforcement sheet

metal 22 and 24.

[0013] In invention concerning this claim 4 or claim 6, by arranging a reinforcement foil or reinforcement sheet metal 22 and 24, breakage of the positive-electrode charge collector foil 12 in the outside at the time of incurvating a rechargeable battery 10, a crack [in / you make it go away negative-electrode charge collector foil 15, and / a part], etc. can be prevented, and the dependability of a rechargeable battery 10 can be raised. When closing eye 25 a pigeon here as the thickness of reinforcement sheet metal 22 and 24 is less than 0.05mm, or when carrying out ultrasonic welding, and there is a possibility that reinforcement sheet metal 22 and 24 may be destroyed and the thickness exceeds 0.5mm, there is a possibility that you may make it go away pigeon 25, and a defect and poor welding may occur. In addition, the still more desirable thickness of reinforcement sheet metal 22 and 24 is 0.1-0.3mm.

[0014]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained in detail based on a drawing. As shown in drawing 1 and drawing 5 , the lithium ion polymer rechargeable battery 10 infixes the polymer electrolyte layer 17 between the positive-electrode sheet 11 and the negative-electrode sheet 14, and carries out the laminating of the positive-electrode sheet 11 and the negative-electrode sheet 14. Positive active material 13 is applied to the front face of the positive-electrode charge collector foil 12, and, as for the positive-electrode sheet 11, the negative-electrode active material 16 is applied to the front face of the negative-electrode charge collector foil 15, as for the negative-electrode sheet 14. Moreover, the polymer electrolyte layer 17 is infixed in the positive-electrode charge collector foil 12 between the negative-electrode active materials 16 by which spreading formation was carried out on the front face of the positive active material 13 by which spreading formation was carried out, and the negative-electrode charge collector foil 15. In order that this lithium ion polymer rechargeable battery 10 may expand discharge capacity, that band-like negative-electrode charge collector foil 15 is folded up by the front face of the negative-electrode active material 16 in the condition with the polymer electrolyte layer 17 using the band-like negative-electrode charge collector foil 15. In addition, the negative-electrode charge collector foil 15 in the gestalt of this operation is a Cu foil, and the active material of a graphite system is used for the negative-electrode active material 16.

[0015] As shown in drawing 9 (a) and (b), the concrete formation procedure to the front face of the negative-electrode charge collector foil 15 of the negative-electrode active material 16 is performed by applying to the top face of the band-like negative-electrode

charge collector foil 15 the slurry which carried out distributed mixing and produced the active material in the solution with a doctor blade method, and drying. On the other hand, the negative-electrode active material 16 is formed in the top face of the negative-electrode charge collector foil 15 in drawing which is a front face except for flank 15b of another side, and the polymer electrolyte layer 17 is made by the top face of the negative-electrode active material 16 by carrying out spreading desiccation of the electrolyte slurry. The polymer electrolyte layer 17 is formed so that it may have the area which covers this negative-electrode active material 16. As shown in drawing 9 (c), an electrolyte slurry is applied so that the negative-electrode active material 16 may be covered, and, specifically, it is formed in the area which covers the negative-electrode active material 16 by drying after that.

[0016] It returns to drawing 5 and two or more positive-electrode sheets 11 which have the area to which the lithium ion polymer rechargeable battery 10 ****ed in a fold-up area, respectively between the polymer electrolyte layers 17 except the fold of the folded-up negative-electrode sheet 14 are pinched. The positive-electrode charge collector foil 12 in the gestalt of this operation with which the polymer electrolyte layer 17 is formed also in the front face of the positive active material 13 of the positive-electrode sheet 11 pinched is an aluminum foil, and LiCoO2 is used for positive active material 13.

[0017] The concrete production procedure of the positive-electrode sheet 11 forms positive active material 13 in the top face of the band-like aluminum foil 18 which turns into a positive-electrode charge collector foil behind first by applying the slurry which carried out distributed mixing of the active material at the solution with a doctor blade method, and drying, as shown in drawing 8 R> 8 (a) and (b). Positive active material 13 is formed except for one flank of the aluminum foil 18, and the polymer electrolyte layer 17 is formed so that it may have the area which covers this positive active material 13. As shown in drawing 8 (c), an electrolyte slurry is applied so that positive active material 13 may be covered, and, specifically, is formed in the area which covers positive active material 13 by drying after that. As shown in drawing 8 (d) after that, the band-like aluminum foil 18 which has positive active material 13 and the polymer electrolyte layer 17 is cut so that it may have the area which ****ed in the folding area of the negative-electrode sheet 14 with the positive active material 13 and the polymer electrolyte layer 17. Thereby, positive active material 13 is formed in the front face of the positive-electrode charge collector foil 12, and two or more positive-electrode sheets 11 of a predetermined area which has the polymer electrolyte layer 17 on the positive-active-material 13 front face are made.

[0018] Subsequently, as shown in drawing 7 , the polymer electrolyte layer 17 is infixed in between, and the laminating of the positive-electrode sheet 11 and the negative-electrode sheet 14 is carried out. This laminating is performed by thermocompression bonding. That is, arrange two or more positive-electrode sheets 11 in the predetermined pitch which ****s at spacing of a fold on the negative-electrode sheet 14, and it is made to pass, as shown in the continuous-line arrow head of drawing between the roller 19 of a couple which rotates to the opposite direction heated by temperature predetermined in the condition, respectively, and 19, and where the polymer electrolyte layer 17 is infixed, thermocompression bonding of the positive-electrode sheet 11 and the negative-electrode sheet 14 is carried out. Arrangement of a up to [the negative-electrode sheet 14 of two or more positive-electrode sheets 11] One edge 12b of two or more positive-electrode charge collector foils 12 From one edge 15b of the band-like negative-electrode charge collector foil 15 to a projection From other-end section 12a of two or more positive-electrode charge collector foils 12, other-end section 15a of the band-like negative-electrode charge collector foil 15 opens a projection and the part in which each positive-electrode sheet 11 is equivalent to the fold of the negative-electrode sheet 14, and is arranged so that it may carry out.

[0019] As shown in drawing 6 , folding of the negative-electrode sheet 14 with which the laminating of the positive-electrode sheet 11 was carried out in this way is performed by bending by turns the fold of the negative-electrode sheet 14 with which the positive-electrode sheet 11 is not arranged. Thus, if it folds up, as shown in drawing 5 , between the polymer electrolyte layers 17 except the fold of the negative-electrode sheet 14 folded up in this way, two or more positive-electrode sheets 11 which have the area which ****ed in a fold-up area, respectively will be pinched. And as shown in drawing 1 , in one edge 12b of two or more positive-electrode charge collector foils 12, other-end section 15a of the projection from one edge 15b of the band-like negative-electrode charge collector foil 15 and the band-like negative-electrode charge collector foil 15 projects from other-end section 12a of two or more positive-electrode charge collector foils 12.

[0020] As shown in drawing 1 and drawing 2 , the laminating of one edge 12b of two or more positive-electrode charge collector foils 12 which projected from one edge 15b of the negative-electrode charge collector foil 15 is divided and carried out to two or more sets in order of a laminating. And one edge each of two or more positive-electrode terminals 23 which responded to the number of groups is inserted between one edge 12b of the positive-electrode charge collector foil 12 by which the laminating was carried out

for every group. With the gestalt of this operation, the laminating of one edge 12b of the positive-electrode charge collector foil 12 is divided and carried out to 2 sets in order of a laminating, it is inserted between one edge 12b of the positive-electrode charge collector foil 12 with which the laminating of the one edge each of the sheet-like positive-electrode terminal 23 of two sheets was carried out for every group, and is connected to one edge 12b of the positive-electrode charge collector foil 12. Similarly the laminating also of the other-end section 15a of two or more negative-electrode charge collector foils 15 which projected from other-end section 12a of the positive-electrode charge collector foil 12 is divided and carried out to 2 sets in order of a laminating. And one edge each of the negative-electrode terminal 21 of the shape of a sheet of two sheets according to the number of groups is inserted between other-end section 15a of the negative-electrode charge collector foil 15 by which the laminating was carried out for every group, and is connected to other-end section 15a of the negative-electrode charge collector foil 15. The expanded metal which has flexibility, respectively, or the punched metal sheet is used for the positive-electrode terminal 23 and the negative-electrode terminal 21 in a gestalt of this operation.

[0021] The connection with other-end section 15a of the negative-electrode charge collector foil 15 and the end of the negative-electrode terminal 21 by which the laminating was carried out for every connection with one edge 12b of the positive-electrode charge collector foil 12 and the end of the positive-electrode terminal 23 in the gestalt of this operation by which the laminating was carried out for every group, and group the spacing t predetermined to the direction which intersects the path of insertion in the state of insertion of the positive-electrode terminal 23 and the negative-electrode terminal 21 (drawing 2) -- opening -- it is carried out by two or more closed eyes 25 a pigeon. When connection [25 / this pigeon] is concretely explained on behalf of the case where the negative-electrode terminal 21 is connected, as shown in drawing 4 , eye 25 a pigeon has fixed flange 25c continued and formed in one edge of body 25a and its body 25a. On the other hand, in the laminating outside surface of other-end section 15a by which the laminating was carried out for every group of the negative-electrode charge collector foil 15 with which the end of the negative-electrode terminal 21 was inserted in between, the reinforcement foil or the reinforcement sheet metal 22 whose thickness it is Cu which is the same construction material as the construction material of the negative-electrode charge collector foil 15, and is 0.05-0.5mm is arranged, respectively. And the predetermined spacing t (drawing 2) is opened in the direction which intersects the path of insertion of the end of the negative-electrode terminal 21 where the laminating of them is carried out to the end of

other-end section 15a by which the laminating was carried out for every group of a reinforcement foil or reinforcement sheet metal 22, and the negative-electrode charge collector foil 15, and the negative-electrode terminal 21, as shown in drawing 4 (a), and two or more breakthroughs 27 are formed.

[0022] As shown in drawing 4 (b), body 25a of eye 25 a pigeon is inserted in the breakthrough 27 until fixed flange 25b contacts a hole edge. Then, the other-end section of body 25a penetrates a breakthrough 27, and projects from a reinforcement foil or reinforcement sheet metal 22. By stuffing the edge of caulking punch 28 into the other-end section of this projecting body 25a, that edge forms pawl 25c which can extend mechanically and is shown in drawing 4 (c). When it can extend in the other-end section of body 25a, 25d of slitting to divide that edge into eight is formed, and when it is able to extend thoroughly, it consists of gestalten of this operation so that eight pawl 25c may form a radial. Pawl 25c of eight radials contacts the hole edge of another side of a breakthrough 27, and pinches other-end section 15a by which the laminating was carried out for every group of the negative-electrode charge collector foil 15 with fixed flange 25a with the end of a reinforcement foil or reinforcement sheet metal 22, and the negative-electrode terminal 21. Thereby, the end of the negative-electrode terminal 21 is connected to other-end section 15a by which the laminating was carried out for every group of two or more negative-electrode charge collector foils 15, respectively.

[0023] As shown in drawing 1 and drawing 2 , the laminating was carried out for every group of the positive-electrode charge collector foil 12, and the reinforcement foil or the reinforcement sheet metal 24 whose thickness it is thin in the laminating outside surface of edge 12b from aluminum which is the same construction material as the construction material of the positive-electrode charge collector foil 12 is 0.05-0.5mm is arranged, respectively. And the laminating of while was carried out for every group of a reinforcement foil or reinforcement sheet metal 24, and the positive-electrode charge collector foil 12, and the breakthrough which opens the predetermined spacing t (drawing 2) in the direction which intersects the path of insertion of the end of the positive-electrode terminal 23 where the laminating of them is carried out, and plurality does not illustrate is formed in the end of edge 12b and the positive-electrode terminal 23. eye 25 a pigeon mentioned above inserts in this breakthrough -- having -- it is closed, and for every group of two or more positive-electrode charge collector foils 12, the laminating of while was carried out and the end of the positive-electrode terminal 23 is connected to edge 12b, respectively. In addition, the reinforcement foil or the reinforcement sheet metal 22 and 24 arranged on a laminating outside surface is made so that pawl 25c made to go away pigeon 25 may have an area larger than wrap area,

and it is made for a superfluous load not to join each of the positive-electrode charge collector foil 12 at the time of a caulking, and the negative-electrode charge collector foil 15.

[0024] The layered product 20 shown in drawing 2 to which the band-like negative-electrode sheet 14 was folded up on both sides of two or more positive-electrode sheets 14, and the positive-electrode terminal 23 and the negative-electrode terminal 21 were connected As shown in drawing 3 , it is sealed with a package 26 so that the other end of the positive-electrode terminal 23 and the other end of the negative-electrode terminal 21 may be expressed. 26d of terminal output port of the number according to the number of groups which can express each other end of the positive-electrode terminal 23 of two sheets and each other end of the negative-electrode terminal 21 of two sheets according to an individual is formed in this par cage 26. As shown in drawing 1 and drawing 5 , the package 26 in the gestalt of this operation is formed in the front face and rear face of a layered product 20 of auxiliary-seat 26c of the couple arranged in the condition of having been turned up, respectively between the package sheets 26a and 26b of a wrap couple, and the positive-electrode terminals 23 and 23 of two sheets, and between the negative-electrode terminals 21 and 21 of two sheets. The aluminium foil with which denaturation polypropylene laminated auxiliary-seat 26of package sheet [of a couple]a [26] and 26b and couple c, respectively is used. Auxiliary-seat 26c of a couple is turned up, respectively so that the laminated denaturation polypropylene may express to a table, and it is arranged among the negative-electrode terminals 21 and 21 of two sheets between the positive-electrode terminals 23 and 23 of two sheets in the condition. By carrying out thermocompression bonding of the perimeter which sandwiches a layered product 20 from a front face and a rear face with the package sheets 26a and 26b of a couple, and the package sheet 26 of a couple piled up in the vacuum ambient atmosphere, a layered product 20 is sealed with a package 26 so that the other end of the positive-electrode terminal 23 and the other end of the negative-electrode terminal 21 may express to ******, respectively.

[0025] Between the perimeter of the package sheets 26a and 26b of a couple, and auxiliary-seat 26c, the positive-electrode terminal 23 and the negative-electrode terminal 21 should be caught, respectively in the case of seal to be shown in drawing 1 . Thermocompression bonding of the perimeter of the package sheets 26a and 26b of a couple and the auxiliary-seat 26c is carried out in the condition, and 26d of terminal [package / 26 / in the part the positive-electrode terminal 23 and whose negative-electrode terminal 21 were pinched] output port after thermocompression bonding is formed. With the gestalt of this operation, since the positive-electrode

terminal 23 and the negative-electrode terminal 21 are formed with the expanded metal or the punched metal sheet, respectively If thermocompression bonding of the perimeter of the package sheet 26 and the auxiliary-seat 26c is carried out Carry out the thermal melting solution of the denaturation polypropylene laminated in aluminium foil, and it trespasses upon punching of the stitch of an expanded metal, or a metal sheet. Since denaturation polypropylene hardens after that, the adhesion of 26d of terminal output port in a package 26, the positive-electrode terminal 23, and the negative-electrode terminal 21 is secured, and seal of the layered product 20 by the package 26 is ensured.

[0026] As shown in drawing 3 , the laminating of each other end of each other end of two or more positive-electrode terminals 23 and 23 pulled out from 26d of each terminal output port of a package 26 and two or more negative-electrode terminals 21 and 21 is carried out, respectively, and it is constituted possible [adhesion]. With the gestalt of this operation, the laminating of each other end of the expanded metal which is a terminal, or the punched metal sheet is carried out. Resistance welding or by carrying out ultrasonic welding or the thing for which eye a pigeon is closed -- or by soldering, by using each other end of the positive electrode which pasted up each other end of a positive electrode and the negative-electrode terminals 21 and 23, and was pasted up in this way, and the negative-electrode terminals 21 and 23 as a terminal of a cell, it is constituted so that the desired electrical and electric equipment may be obtained.

[0027] thus, in the constituted lithium ion polymer rechargeable battery 10 One edge 12b of two or more positive-electrode charge collector foils 12 is divided into two or more sets in order of a laminating. Insert one edge each of two or more positive-electrode terminals 21 which responded to the number of groups between one edge 12b of the positive-electrode charge collector foil 12 by which the laminating was carried out for every group, and it connects with edge 12b of one of these. Other-end section 15a of two or more negative-electrode charge collector foils 15 is divided into two or more sets in order of a laminating. Since it inserted between other-end section 15a of the negative-electrode charge collector foil 15 which carried out the laminating of the one edge each of two or more negative-electrode terminals 21 which responded to the number of groups for every group and connected with the other-end section 15a Only by making the number of terminals 21 and 23 increase, it can become possible to expand the cross section, the cross section of the terminal according to the increased discharge capacity can be obtained comparatively easily, and the rechargeable battery which is comparatively easy to incurvate as compared with the case where the comparatively thick single terminal of thickness is connected can be obtained.

[0028] Moreover, the end of the positive-electrode terminal 23 is inserted between one

edge 12b of each class by which the laminating was divided and carried out to two or more sets in order of the laminating of two or more positive-electrode charge collector foils 12. Since the end of the negative-electrode terminal 21 is inserted between other-end section 15a to which the laminating of each class by which the laminating was divided and carried out to two or more sets in order of the laminating of two or more negative-electrode charge collector foils 15 was carried out Even if it repeats a rechargeable battery 10 and incurvates it, between the positive-electrode charge collector foils 12 the positive-electrode terminal 23 and whose positive-electrode terminal 23 of its are pinched Or a clearance is not generated between the negative-electrode charge collector foils 15 the negative-electrode terminal 21 and whose negative-electrode terminal 21 of its are pinched, and the conductivity in the contact part is secured and can fully reduce the resistance in a terminal joint.

[0029] moreover, the connection with one edge 12b of two or more positive-electrode charge collector foils 12 and other-end section 15a of two or more negative-electrode charge collector foils 15, the positive-electrode terminal 23, and the negative-electrode terminal 21 -- the predetermined spacing t -- opening, since it is carried out by two or more closed eyes 25 a pigeon Lifting of a mechanical strength can be controlled as compared with the case where all the parts of the edge by which the laminating was carried out are joined, and the flexible nature which the sheet-like rechargeable battery 10 has from the former can be secured. Furthermore, since a reinforcement foil or reinforcement sheet metal 22 has been arranged on the laminating outside surface of other-end section 15a on which a reinforcement foil or reinforcement sheet metal 24 has been arranged on the laminating outside surface of edge 12b, and the laminating of the negative-electrode charge collector foil 15 was carried out for while the laminating of the positive-electrode charge collector foil 12 was carried out Breakage of the positive-electrode charge collector foil 12 in the outside at the time of incurvating a rechargeable battery 10, a crack [in / you make it go away negative-electrode charge collector foil 15, and / a part], etc. can be prevented, and the dependability of a rechargeable battery 10 can be raised.

[0030] In addition, although the band-like negative-electrode sheet 14 with which thermocompression bonding of two or more positive-electrode sheets 11 in a predetermined pitch was carried out was bent by turns in the gestalt of operation mentioned above with the fold by which the positive-electrode sheet 11 is not arranged The laminating of two or more same positive-electrodes charge collector foil as a positive-electrode sheet in which number-prepare, a polymer electrolyte layer is made to intervene between positive active material and a negative-electrode active material,

respectively, and those sheets are constituted, and two or more negative-electrode charge collector foils may be carried out for a positive-electrode sheet and two or more negative-electrode sheets of isomorphous ** size.

[0031] Moreover, although one edge each of terminals 21 and 23 was connected to one edge 12b of the positive-electrode charge collector foil 12, or other-end section 15a of the negative-electrode charge collector foil 15 by two or more eyes 25 a pigeon with the gestalt of operation mentioned above Between one edge 12b of the positive-electrode charge collector foil 12 with which the laminating of the one edge each of two or more positive-electrode terminals 23 was carried out for every group One edge each of the positive-electrode terminal 23 is connected to one edge 12b of two or more positive-electrode charge collector foils 12 by opening and carrying out two or more place ultrasonic welding of the predetermined spacing t in the direction which intersects the path of insertion in the condition of having been inserted. Between other-end section 15a of the negative-electrode charge collector foil 15 with which the laminating of the one edge each of two or more negative-electrode terminals 21 was carried out for every group One edge each of the negative-electrode terminal 21 may be connected to other-end section 15a of two or more negative-electrode charge collector foils 15 by opening and carrying out two or more place ultrasonic welding of the predetermined spacing t in the direction which intersects the path of insertion in the condition of having been inserted. When it connects by ultrasonic welding, while being able to save the time and effort which forms the breakthrough 27 needed when connecting [use / 25 / a pigeon], lifting of a mechanical strength can be controlled as compared with the case where all the parts of the edges 12a and 15b by which the laminating was carried out are joined, and the flexible nature can be secured.

[0032]

[Effect of the Invention] As stated above, according to this invention, one edge of two or more positive-electrode charge collector foils is divided into two or more sets in order of a laminating. Insert one edge each of two or more positive-electrode terminals which responded to the number of groups between one edges of the positive-electrode charge collector foil by which the laminating was carried out for every group, and it connects with one edge of a positive-electrode charge collector foil. Divide the other-end section of two or more negative-electrode charge collector foils into two or more sets in order of a laminating, insert one edge each of two or more negative-electrode terminals which responded to the number of groups between the other-end sections of the negative-electrode charge collector foil by which the laminating was carried out for every group, and it connects with the other-end section of a negative-electrode charge

collector foil. It has terminal output port of the number according to the number of groups as which a package can express each other end of two or more positive-electrode terminals, and each other end of two or more negative-electrode terminals according to an individual. And since the laminating of each other end of each other end of two or more positive-electrode terminals and two or more negative-electrode terminals was carried out, respectively and it constituted possible [adhesion] The rechargeable battery which is comparatively easy to incurvate as compared with the case where become possible to expand the cross section, and can obtain comparatively easily the cross section of the terminal according to the increased discharge capacity only by making the number of terminals increase, and the comparatively thick single terminal of thickness is connected can be obtained.

[0033] Moreover, since the end of a positive-electrode terminal is inserted between the other-end sections to which it was inserted between edges and the laminating of while the laminating was carried out for every group of two or more positive-electrode charge collector foils was carried out for every group of the negative-electrode charge collector foil of plurality [end / of a negative-electrode terminal] Even if it repeats a rechargeable battery and incurvates it, between the positive-electrode charge collector foils a positive-electrode terminal and whose positive-electrode terminal of its are pinched Or a clearance is not generated between the negative-electrode charge collector foils a negative-electrode terminal and whose negative-electrode terminal of its are pinched, and the conductivity in the contact part is secured and can fully reduce the resistance in a terminal joint. Furthermore, although the laminating of one edge of two or more positive-electrode charge collector foils and the other-end section of two or more negative-electrode charge collector foils is carried out for every group, respectively and the positive-electrode terminal and negative-electrode terminal according to the number of groups are connected the connection -- predetermined spacing -- opening -- two or more closed eyes a pigeon -- or, if it carries out by carrying out two or more place ultrasonic welding Lifting of a mechanical strength can be controlled as compared with the case where all the parts of the edge by which the laminating was carried out are joined, and the flexible nature which the sheet-like rechargeable battery 10 has from the former can be secured.

[Brief Description of the Drawings]

[Drawing 1] The B-B line sectional view of drawing 5 showing the rechargeable battery of this invention.

[Drawing 2] The perspective view showing the layered product to which the laminating of the positive electrode and the negative-electrode sheet was carried out, and the

terminal was connected.

[Drawing 3] The perspective view showing the rechargeable battery of this invention by which the layered product was sealed with a package.

[Drawing 4] The sectional view showing the procedure of closing eye the pigeon.

[Drawing 5] The A-A line sectional view of drawing 1 showing the rechargeable battery.

[Drawing 6] The decomposition perspective view showing the configuration of the rechargeable battery.

[Drawing 7] The perspective view showing the condition that thermocompression bonding of the positive-electrode sheet is carried out to the negative-electrode sheet.

[Drawing 8] Drawing showing the production process of the positive-electrode sheet.

[Drawing 9] Drawing showing the production process of the negative-electrode sheet.

[Description of Notations]

10 Lithium Ion Polymer Rechargeable Battery

12 Positive-Electrode Charge Collector Foil

12a Other-end section

12b One edge

13 Positive Active Material

15 Negative-Electrode Charge Collector Foil

15a Other-end section

15b One edge

16 Negative-Electrode Active Material

17 Polymer Electrolyte Layer

21 Negative-Electrode Terminal

22 Reinforcement Foil or Reinforcement Sheet Metal

23 Positive-Electrode Terminal

24 Reinforcement Foil or Reinforcement Sheet Metal

25 Eye Pigeon

26 Package

26d Terminal output port

t Predetermined spacing

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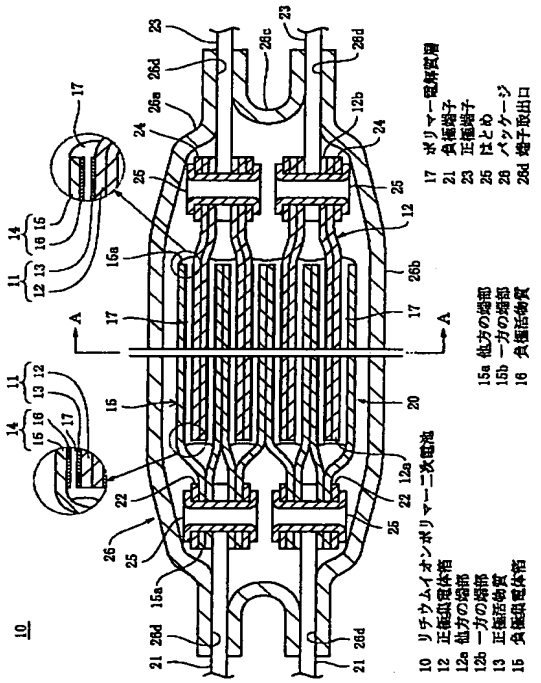
(54)【発明の名称】　リチウムイオンポリマー二次電池

(57)【要約】
【課題】　放電容量に応じた端子の必要断面積を得るとともに、フレキシブル性を確保しつつ端子接合部における抵抗を低減する。
【解決手段】複数の正極集電体箔１２の一方の端部１２ｂが積層順に複数組に分けられ、組数に応じた複数の正極端子２３の各一端が組毎に積層された正極集電体箔の一方の端部１２ｂの間に挿入されてその一方の端部１２ｂに接続され、複数の負極集電体箔１５の他方の端部１５ａが積層順に複数組に分けられ、組数に応じた複数の負極端子２１の各一端が組毎に積層された負極集電体箔の他方の端部１５ａの間に挿入されてその他方の端部１５ａに接続され、パッケージ２６が複数の正極端子２３の各他端と複数の負極端子２１の各他端とを個別に表出し得る端子取出口２６ｄを有し、かつ複数の正極端子２３の各他端及び複数の負極端子２１の各他端がそれぞれ積層されて接着可能に構成される。



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【特許請求の範囲】

【請求項１】　複数の正極集電体箔(12)の各表面に正極活物質(13)が塗布され、複数の負極集電体箔(15)の各表面に負極活物質(16)が塗布され、前記複数の正極集電体箔(12)と前記複数の負極集電体箔(15)とが前記正極活物質(13)と前記負極活物質(16)との間にそれぞれポリマー電解質層(17)を介して積層され、前記負極集電体箔(15)の一方の端部(15b)から突出する前記複数の正極集電体箔(12)の全ての一方の端部(12b)にシート状の正極端子(23)の一端が接続され、前記正極集電体箔(12)の他方の端部(12a)から突出する前記複数の負極集電体箔(15)の全ての他方の端部(15a)にシート状の負極端子(21)の一端が接続され、前記正極端子(23)の他端及び前記負極端子(21)の他端を表出するように前記正極集電体箔(12)と前記負極集電体箔(15)との(20)がパッケージ(26)により密閉されたリチウムイオンポリマー二次電池において、
前記複数の正極集電体箔(12)の一方の端部(12b)が積層順に複数組に分けられ、前記組数に応じた複数の正極端子(23)の各一端が組毎に積層された前記正極集電体箔の一方の端部(12b)の間に挿入されて前記正極集電体箔の一方の端部(12b)に接続され、
前記複数の負極集電体箔(15)の他方の端部(15a)が積層順に複数組に分けられ、前記組数に応じた複数の負極端子(21)の各一端が組毎に積層された前記負極集電体箔の他方の端部(15a)の間に挿入されて前記負極集電体箔の他方の端部(15a)に接続され、
前記パッケージ(26)が前記複数の正極端子(23)の各他端と前記複数の負極端子(21)の各他端とを個別に表出し得る前記組数に応じた数の端子取出口(26d)を有し、かつ前記複数の正極端子(23)の各他端及び前記複数の負極端子(21)の各他端がそれぞれ積層されて接着可能に構成されたリチウムイオンポリマー二次電池。

【請求項２】　複数の正極端子(23)及び複数の負極端子(21)がそれぞれエキスパンデッドメタル又は穿孔された金属シートである請求項１記載のリチウムイオンポリマー二次電池。

【請求項３】　複数の正極端子(23)の各一端が組毎に積層された正極集電体箔(12)の一方の端部(12b)の間に挿入された状態で挿入方向と交差する方向に所定の間隔(t)をあけてかしめられた複数のはとめ(25)により前記正極端子(23)の各一端が前記複数の正極集電体箔(12)の一方の端部(12b)に接続され、
複数の負極端子(21)の各一端が組毎に積層された負極集電体箔(15)の他方の端部(15a)の間に挿入された状態で挿入方向と交差する方向に所定の間隔(t)をあけてかしめられた複数のはとめ(25)により前記負極端子(21)の各一端が前記複数の負極集電体箔(15)の他方の端部(15a)に接続された請求項１又は２記載のリチウムイオンポリマー二次電池。

【請求項４】　正極集電体箔(12)の材質又は負極集電体箔(15)の材質と同一材質であって０．０５～０．５mmの厚さを有する補強箔又は補強薄板(22, 24)が前記正極集電体箔(12)又は前記負極集電体箔(15)のいずれか一方又は双方の端部の組毎に積層されたそれぞれの外面に配置され、前記補強箔又は補強薄板(22, 24)を介して複数のはとめ(25)がそれぞれかしめられた請求項３記載のリチウムイオンポリマー二次電池。

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【請求項５】　複数の正極端子(23)の各一端が組毎に積層された前記正極集電体箔(12)の一方の端部の間に挿入された状態で挿入方向と交差する方向に所定の間隔(t)をあけて複数個所超音波溶接することにより前記正極端子(23)の各一端が前記複数の正極集電体箔(12)の一方の端部(12b)に接続され、
複数の負極端子(21)の各一端が組毎に積層された前記負極集電体箔(15)の他方の端部(15a)の間に挿入された状態で挿入方向と交差する方向に所定の間隔(t)をあけて複数個所超音波溶接することにより前記負極端子(21)の各一端が前記複数の負極集電体箔(15)の他方の端部(15a)に接続された請求項１又は２記載のリチウムイオンポリマー二次電池。

【請求項６】　正極集電体箔(12)の材質又は負極集電体箔(15)の材質と同一材質であって０．０５～０．５mmの厚さを有する補強箔又は補強薄板(22, 24)が前記正極集電体箔(12)又は前記負極集電体箔(15)のいずれか一方又は双方の端部の組毎に積層されたそれぞれの外面に配置され、前記補強箔又は補強薄板(22, 24)を介して超音波溶接された請求項５記載のリチウムイオンポリマー二次電池。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ポリマー電解質層を介して正極活物質と負極活物質を積層したリチウムイオンポリマー二次電池に関するものである。

【０００２】

【従来の技術】従来、ビデオカメラやノート型パソコン等のポータブル機器の普及によって薄くてある程度フレキシブルな電池に対する需要が高まっている。この薄型の電池として、正極シートと負極シートを積層して形成されたリチウムイオンポリマー二次電池が知られている。この正極シートは、正極集電体箔の表面に活物質を塗布することにより作られ、負極シートは負極集電体箔の表面に活物質を塗布することにより作られる。正極シートの活物質と負極シートの活物質の間にはポリマー電解質層が介装される。この電池では、それぞれの活物質における電位差を電流として取出すための正極端子及び負極端子が正極集電体箔及び負極集電体箔に設けられ、このように積層された積層体をパッケージで密閉することによりリチウムイオンポリマー二次電池が作成される。このリチウムイオンポリマー二次電池ではパッケージから引出された正極端子及び負極端子を電池の端子と

して使用することにより所望の電気が得られるようになっている。

【０００３】また、近年ではリチウムイオンポリマー二次電池の放電容量を増大させる傾向にあり、複数枚の正極シート及び複数枚の負極シートを用いて積層し、その放電容量を増大させたり、単一の正極シート及び単一の負極シートの面積を拡大させ、拡大した正極シート及び負極シートを所望の大きさに折畳むことによりその放電容量を拡大している。一方、正極シート及び負極シートを複数枚用いるか或いは折り畳んで放電容量を拡大することに伴い、層状に引き出された複数枚の正極集電体箔及び負極集電体箔の端部を互いに接続させて正極端子及び負極端子を接続することが必要である。この接続手段として、層状に引き出された複数枚の正極集電体箔及び負極集電体箔の端部を分離して束ね、端子を兼ねる導電体でこの束ねた端部を挟み、束ねられた端部と導電体を溶接してその導電体を通じて電気を取り出すようにした二次電池が提案されている（特開平７－２６３０２９）。

【０００４】

【発明が解決しようとする課題】しかし、束ねられた正極集電体箔又は負極集電体箔の全ての端部と導電体とを溶接によって接合したときには、その接合部分における機械的強度が溶接により高まり、電池のフレキシブル性が失われる不具合がある。特に増大させた放電容量に応じた端子の断面積を確保するために、端子の断面積が比較的大きな棒状の金属片からなる導電体を用いた場合にはその接合部分における可撓性か完全に失われる欠点がある。逆に、比較的可撓性を有する導電体で挟み、その導電体と束ねられた端部を部分的に溶接したときには、電池のフレキシブル性を保つことはできるけれども、増大させた放電容量に応じた端子の必要断面積を得ることが困難になるとともに、電池を湾曲させることにより溶接された部分以外の端部と外側から挟んだ導電体との間に隙間が生じ、その部分における導電性が失われ、結果として抵抗値が増加して十分な電力を得られない問題がある。本発明の目的は、放電容量に応じた端子の必要断面積を比較的容易に得ることのできるリチウムイオンポリマー二次電池を提供することにある。本発明の別の目的は、フレキシブル性を確保しつつ端子接合部における抵抗を低減し得るリチウムイオンポリマー二次電池を提供することにある。

【０００５】

【課題を解決するための手段】請求項１に係る発明は、図１及び図２に示すように、複数の正極集電体箔１２の各表面に正極活物質１３が塗布され、複数の負極集電体箔１５の各表面に負極活物質１６が塗布され、複数の正極集電体箔１２と複数の負極集電体箔１５とが正極活物質１３と負極活物質１６との間にそれぞれポリマー電解質層１７を介して積層され、負極集電体箔１５の一方の

端部１５ｂから突出する複数の正極集電体箔１２の全ての一方の端部１２ｂにシート状の正極端子２３の一端が接続され、正極集電体箔１２の他方の端部１２ａから突出する複数の負極集電体箔１５の全ての他方の端部１５ａにシート状の負極端子２１の一端が接続され、正極端子２３の他端及び負極端子２１の他端を表出するように正極集電体箔１２と負極集電体箔１５との積層体２０がパッケージ２６により密閉されたリチウムイオンポリマー二次電池の改良である。

【０００６】その特徴ある構成は、複数の正極集電体箔１２の一方の端部１２ｂが積層順に複数組に分けられ、組数に応じた複数の正極端子２３の各一端が組毎に積層された正極集電体箔の一方の端部１２ｂの間に挿入されて正極集電体箔の一方の端部１２ｂに接続され、複数の負極集電体箔１５の他方の端部１５ａが積層順に複数組に分けられ、組数に応じた複数の負極端子２１の各一端が組毎に積層された負極集電体箔の他方の端部１５ａの間に挿入されて負極集電体箔の他方の端部１５ａに接続され、パッケージ２６が複数の正極端子２３の各他端と複数の負極端子２１の各他端とを個別に表出し得る組数に応じた数の端子取出口２６ｄを有し、かつ複数の正極端子２３の各他端及び複数の負極端子２１の各他端がそれぞれ積層されて接着可能に構成されたところにある。

【０００７】この請求項１に係る発明では、端子２１，２３の数を増加させるだけでその断面積を拡大することが可能になり、増大させた放電容量に応じた端子の断面積を比較的容易に得ることができる。また、厚さの比較的厚い単一の端子を接続する場合に比較して比較的湾曲させやすい二次電池を得ることができる。また、正極端子２３の一端は複数の正極集電体箔１２の組毎に積層された一方の端部１２ｂの間に挿入され、負極端子２１の一端は複数の負極集電体箔１５の組毎に積層された他方の端部１５ａの間に挿入されるので、二次電池１０を繰り返し湾曲させても、正極端子２３とその正極端子２３を挟む正極集電体箔１２の間に、又は負極端子２１とその負極端子２１を挟む負極集電体箔１５の間に隙間が生じることはなく、その接触部分における導電性は確保され、端子接合部における抵抗を十分に低減することができる。

【０００８】請求項２に係る発明は、請求項１に係る発明であって、複数の正極端子２３及び複数の負極端子２１がそれぞれエキスパンデッドメタル又は穿孔された金属シートであるリチウムイオンポリマー二次電池である。この請求項２に係る発明では、端子２１，２３自体の可撓性を確保することによりシート状の二次電池１０のフレキシブル性を確実に確保するとともに、パッケージ２６との密着性を向上させてそのパッケージ２６による二次電池の密封性を確保することができる。

【０００９】請求項３に係る発明は、請求項１又は２に係る発明であって、複数の正極端子２３の各一端が組毎

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に積層された正極集電体箔１２の一方の端部１２ｂの間に挿入された状態で挿入方向と交差する方向に所定の間隔ｔをあけてかしめられた複数のはとめ２５により正極端子２３の各一端が複数の正極集電体箔１２の一方の端部１２ｂに接続され、複数の負極端子２１の各一端が組毎に積層された負極集電体箔１５の他方の端部１５ａの間に挿入された状態で挿入方向と交差する方向に所定の間隔ｔをあけてかしめられた複数のはとめ２５により負極端子２１の各一端が複数の負極集電体箔１５の他方の端部１５ａに接続されたリチウムイオンポリマー二次電池である。

【００１０】請求項５に係る発明は、請求項１又は２に係る発明であって、複数の正極端子２３の各一端が組毎に積層された正極集電体箔１２の一方の端部１２ｂの間に挿入された状態で挿入方向と交差する方向に所定の間隔ｔをあけて複数箇所超音波溶接することにより正極端子２３の各一端が複数の正極集電体箔１２の一方の端部１２ｂに接続され、複数の負極端子２１の各一端が組毎に積層された負極集電体箔１５の他方の端部１５ａの間に挿入された状態で挿入方向と交差する方向に所定の間隔ｔをあけて複数箇所超音波溶接することにより負極端子２１の各一端が複数の負極集電体箔１５の他方の端部１５ａに接続されたリチウムイオンポリマー二次電池である。

【００１１】この請求項３及び請求項５に係る発明では、複数の正極集電体箔１２の一方の端部１２ｂ及び複数の負極集電体箔１５の他方の端部１５ａをそれぞれ組毎に積層して、その組数に応じた正極端子２３及び負極端子２１を接続するが、その接続は、所定の間隔ｔをあけてかしめられた複数のはとめ２５により又は複数箇所超音波溶接することにより行われるので、積層された端部１２ａ，１５ｂの全ての部分を接合する場合に比較して機械的強度の上昇を抑制することができ、シート状の二次電池１０が従来から有するフレキシブル性を確保することができる。

【００１２】請求項４に係る発明は、請求項３に係る発明であって、正極集電体箔１２の材質又は負極集電体箔１５の材質と同一材質であって０．０５～０．５mmの厚さを有する補強箔又は補強薄板２２，２４が正極集電体箔１２又は負極集電体箔１５のいずれか一方又は双方の端部の組毎に積層されたそれぞれの外面に配置され、補強箔又は補強薄板２２，２４を介して複数のはとめ２５がそれぞれかしめられたリチウムイオンポリマー二次電池である。請求項６に係る発明は、請求項５に係る発明であって、正極集電体箔１２の材質又は負極集電体箔１５の材質と同一材質であって０．０５～０．５mmの厚さを有する補強箔又は補強薄板２２，２４が正極集電体箔１２又は負極集電体箔１５のいずれか一方又は双方の端部の組毎に積層されたそれぞれの外面に配置され、補強箔又は補強薄板２２，２４を介して超音波溶接されたリチウムイオンポリマー二次電池である。

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【００１３】この請求項４又は請求項６に係る発明では、補強箔又は補強薄板２２，２４を配置することにより、二次電池１０を湾曲させた場合の、外側における正極集電体箔１２及び負極集電体箔１５のかしめ箇所における亀裂等の破損を防止でき、二次電池１０の信頼性を向上させることができる。ここで、補強薄板２２，２４の厚さが０．０５mm未満であると、はとめ２５をかしめる時や超音波溶接する時に補強薄板２２，２４が破壊されるおそれがあり、その厚さが０．５mmを越えるとはとめ２５のかしめ不良や溶接不良が発生するおそれがある。なお、補強薄板２２，２４の更に好ましい厚さは０．１～０．３mmである。

【００１４】

【発明の実施の形態】次に本発明の実施の形態を図面に基づいて詳しく説明する。図１及び図５に示すように、リチウムイオンポリマー二次電池１０は、正極シート１１と負極シート１４との間にポリマー電解質層１７を介装し、その正極シート１１及び負極シート１４を積層したものである。正極シート１１は正極集電体箔１２の表面に正極活物質１３が塗布されたものであり、負極シート１４は負極集電体箔１５の表面に負極活物質１６が塗布されたものである。また、ポリマー電解質層１７は正極集電体箔１２に塗布形成された正極活物質１３と負極集電体箔１５の表面に塗布形成された負極活物質１６との間に介装される。このリチウムイオンポリマー二次電池１０は、放電容量を拡大するために帯状の負極集電体箔１５を用い、その帯状の負極集電体箔１５は負極活物質１６の表面にポリマー電解質層１７を有した状態で折畳まれる。なお、この実施の形態における負極集電体箔１５はＣｕ箔であり、負極活物質１６にはグラファイト系の活物質が使用される。

【００１５】図９（ａ）及び（ｂ）に示すように、負極活物質１６の負極集電体箔１５の表面への具体的な形成手順は、活物質を溶液に分散混合して作製したスラリーを帯状の負極集電体箔１５の上面にドクターブレード法により塗布して乾燥することにより行われる。一方、負極活物質１６は他方の側部１５ｂを除いて表面である図における負極集電体箔１５の上面に形成され、ポリマー電解質層１７はその負極活物質１６の上面に電解質スラリーを塗布乾燥することにより作られる。ポリマー電解質層１７はこの負極活物質１６を被覆する面積を有するように形成される。具体的には、図９（ｃ）に示すように、電解質スラリーを負極活物質１６を覆うように塗布し、その後乾燥することにより負極活物質１６を被覆する面積に形成される。

【００１６】図５に戻って、リチウムイオンポリマー二次電池１０は、折畳まれた負極シート１４の折目を除くポリマー電解質層１７の間にそれぞれ折畳み面積に相応した面積を有する複数の正極シート１１が挟持される。

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挟持される正極シート１１の正極活物質１３の表面にもポリマー電解質層１７が形成される、この実施の形態における正極集電体箔１２はＡｌ箔であり、正極活物質１３には例えば$LiCoO_2$が使用される。

【００１７】具体的な正極シート１１の作製手順は、図８（ａ）及び（ｂ）に示すように、活物質を溶液に分散混合したスラリーをドクターブレード法により塗布して乾燥することにより後に正極集電体箔になる帯状のＡｌ箔１８の上面に先ず正極活物質１３を形成する。正極活物質１３はＡｌ箔１８の一方の側部を除いて形成され、ポリマー電解質層１７はこの正極活物質１３を被覆する面積を有するように形成される。具体的には、図８（ｃ）に示すように、電解質スラリーは正極活物質１３を覆うように塗布し、その後乾燥することにより正極活物質１３を被覆する面積に形成される。その後図８（ｄ）に示すように、正極活物質１３及びポリマー電解質層１７を有する帯状のＡｌ箔１８は、その正極活物質１３及びポリマー電解質層１７とともに負極シート１４の折畳み面積に相応した面積を有するように切断される。これにより、正極集電体箔１２の表面に正極活物質１３が形成され、その正極活物質１３表面にポリマー電解質層１７を有する所定の面積の正極シート１１が複数枚作られる。

【００１８】次いで図７に示すように、ポリマー電解質層１７を間に介装して正極シート１１及び負極シート１４が積層される。この積層は熱圧着により行われる。即ち、負極シート１４に折目の間隔に相応する所定のピッチで複数の正極シート１１を配置し、その状態で所定の温度に加熱された反対方向にそれぞれ回転する一対のローラ１９，１９間に図の実線矢印に示すように通過させ、ポリマー電解質層１７を介装した状態で正極シート１１及び負極シート１４を熱圧着する。複数の正極シート１１の負極シート１４上への配置は、複数の正極集電体箔１２の一方の端部１２ｂがその帯状の負極集電体箔１５の一方の端部１５ｂから突出し、帯状の負極集電体箔１５の他方の端部１５ａが複数の正極集電体箔１２の他方の端部１２ａから突出し、するように、またそれぞれの正極シート１１が負極シート１４の折目に相当する部分をあけて配置される。

【００１９】図６に示すように、このように正極シート１１が積層された負極シート１４の折畳みは、正極シート１１が配置されていない負極シート１４の折目を交互に折曲げることにより行われる。このように折畳むと、図５に示すように、このように折畳まれた負極シート１４の折目を除くポリマー電解質層１７の間には、それぞれ折畳み面積に相応した面積を有する複数の正極シート１１が挟持される。そして、図１に示すように、複数の正極集電体箔１２の一方の端部１２ｂは帯状の負極集電体箔１５の一方の端部１５ｂから突出し、帯状の負極集電体箔１５の他方の端部１５ａは複数の正極集電体箔１

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２の他方の端部１２ａから突出する。

【００２０】図１及び図２に示すように、負極集電体箔１５の一方の端部１５ｂから突出した複数の正極集電体箔１２の一方の端部１２ｂは、積層順に複数組に分かれて積層される。そしてその組数に応じた複数の正極端子２３の各一端が組毎に積層された正極集電体箔１２の一方の端部１２ｂの間に挿入される。この実施の形態では、正極集電体箔１２の一方の端部１２ｂは積層順に二組に分かれて積層され、シート状の二枚の正極端子２３の各一端が組毎に積層された正極集電体箔１２の一方の端部１２ｂの間に挿入されて正極集電体箔１２の一方の端部１２ｂに接続される。同様に、正極集電体箔１２の他方の端部１２ａから突出した複数の負極集電体箔１５の他方の端部１５ａも積層順に二組に分かれて積層され、そしてその組数に応じた二枚のシート状の負極端子２１の各一端が組毎に積層された負極集電体箔１５の他方の端部１５ａの間に挿入されて負極集電体箔１５の他方の端部１５ａに接続される。この実施の形態における正極端子２３及び負極端子２１にはそれぞれ可撓性を有するエキスパンデッドメタル又は穿孔された金属シートが用いられる。

【００２１】この実施の形態における組毎に積層された正極集電体箔１２の一方の端部１２ｂと正極端子２３の一端との接続及び組毎に積層された負極集電体箔１５の他方の端部１５ａと負極端子２１の一端との接続は、正極端子２３及び負極端子２１の挿入状態で挿入方向と交差する方向に所定の間隔ｔ（図２）をあけてかしめられた複数のはとめ２５により行われる。このはとめ２５による接続を負極端子２１を接続する場合を代表して具体的に説明すると、図４に示すように、はとめ２５は円筒部２５ａとその円筒部２５ａの一方の端部に連続して形成された固定フランジ２５ｃを有する。一方、負極端子２１の一端が間に挿入された負極集電体箔１５の組毎に積層された他方の端部１５ａの積層外面には、負極集電体箔１５の材質と同一材質であるＣｕであって厚さが０．０５～０．５mmの補強箔又は補強薄板２２がそれぞれ配置される。そして、補強箔又は補強薄板２２、負極集電体箔１５の組毎に積層された他方の端部１５ａ及び負極端子２１の一端には、図４（ａ）に示すようにそれらが積層された状態で負極端子２１の一端の挿入方向と交差する方向に所定の間隔ｔ（図２）をあけて複数の貫通孔２７が形成される。

【００２２】図４（ｂ）に示すように、はとめ２５の円筒部２５ａは、固定フランジ２５ｂが孔縁に当接するまでその貫通孔２７に挿入される。すると円筒部２５ａの他方の端部は貫通孔２７を貫通して補強箔又は補強薄板２２から突出する。この突出した円筒部２５ａの他方の端部にかしめポンチ２８の端部を押し込むことにより、その端部は機械的に押し広げられて図４（ｃ）に示す爪２５ｃを形成する。この実施の形態では円筒部２５ａの

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他方の端部には押し広げられる際にその端部が８つに分割されるようにするための切り込み２５ｄが形成され、完全に押し広げられた際には８つの爪２５ｃが放射状を形成するように構成される。８つの放射状の爪２５ｃは貫通孔２７の他方の孔縁に当接し、固定フランジ２５ａとともに負極集電体箔１５の組毎に積層された他方の端部１５ａを補強箔又は補強薄板２２及び負極端子２１の一端とともに挟持する。これにより、負極端子２１の一端は複数の負極集電体箔１５の組毎に積層された他方の端部１５ａにそれぞれ接続される。

【００２３】図１及び図２に示すように、正極集電体箔１２の組毎に積層された一方の端部１２ｂの積層外面には、正極集電体箔１２の材質と同一材質であるＡｌからなる厚さが０．０５～０．５mmの補強箔又は補強薄板２４がそれぞれ配置される。そして、補強箔又は補強薄板２４、正極集電体箔１２の組毎に積層された一方の端部１２ｂ及び正極端子２３の一端には、それらが積層された状態で正極端子２３の一端の挿入方向と交差する方向に所定の間隔ｔ（図２）をあけて複数の図示しない貫通孔が形成される。この貫通孔には前述したはとめ２５が挿入されてかしめられ、正極端子２３の一端は複数の正極集電体箔１２の組毎に積層された一方の端部１２ｂにそれぞれ接続される。なお、積層外面に配置される補強箔又は補強薄板２２，２４は、はとめ２５のかしめられた爪２５ｃが覆う面積より広い面積を有するように作られ、かしめ時における正極集電体箔１２及び負極集電体箔１５のそれぞれに過剰な負荷が加わらないようにされる。

【００２４】複数の正極シート１４を挟んで帯状の負極シート１４を折畳み正極端子２３及び負極端子２１が接続された図２に示す積層体２０は、図３に示すように、正極端子２３の他端及び負極端子２１の他端を表出するようにパッケージ２６で密封され、このパーケージ２６には２枚の正極端子２３の各他端と２枚の負極端子２１の各他端とを個別に表出し得る組数に応じた数の端子取出口２６ｄが形成される。図１及び図５に示すように、この実施の形態におけるパッケージ２６は、積層体２０の表面及び裏面を覆う一対のパッケージシート２６ａ，２６ｂと、２枚の正極端子２３，２３の間と２枚の負極端子２１，２１の間にそれぞれ折り返された状態で配置される一対の補助シート２６ｃにより形成される。一対のパッケージシート２６ａ，２６ｂ及び一対の補助シート２６ｃはそれぞれ変性ポリプロピレンがラミネートされたアルミニウム箔が用いられる。一対の補助シート２６ｃはラミネートされた変性ポリプロピレンが表に表出するようにそれぞれ折り返され、その状態で２枚の正極端子２３，２３の間と２枚の負極端子２１，２１の間に配置される。一対のパッケージシート２６ａ，２６ｂで積層体２０を表面及び裏面から挟み、真空雰囲気中で一対のパッケージシート２６の重ね合わされた周囲を熱圧着することにより積層体２０は正極端子２３の他端及び負極端子２１の他端がそれぞれそ外部に表出するようにパッケージ２６により密閉される。

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【００２５】図１に示すように、密封の際、一対のパッケージシート２６ａ，２６ｂの周囲と補助シート２６ｃの間には正極端子２３及び負極端子２１がそれぞれ挟まれ、その状態で一対のパッケージシート２６ａ，２６ｂの周囲と補助シート２６ｃは熱圧着され、正極端子２３及び負極端子２１を挟んだ部分におけるパッケージ２６は熱圧着後における端子取出口２６ｄが形成される。この実施の形態では、正極端子２３及び負極端子２１がそれぞれエキスパンデッドメタル又は穿孔された金属シートにより形成されているので、パッケージシート２６の周囲及び補助シート２６ｃを熱圧着すると、アルミニウム箔にラミネートされた変性ポリプロピレンは熱融解してエキスパンデッドメタルの編み目又は金属シートの穿孔に侵入し、その後変性ポリプロピレンが硬化するのでパッケージ２６における端子取出口２６ｄと正極端子２３及び負極端子２１の密着性は確保され、そのパッケージ２６による積層体２０の密封が確実に行われる。

【００２６】図３に示すように、パッケージ２６のそれぞれの端子取出口２６ｄから引出された複数の正極端子２３，２３の各他端及び複数の負極端子２１，２１の各他端はそれぞれ積層されて接着可能に構成される。この実施の形態では、端子であるエキスパンデッドメタル又は穿孔された金属シートの各他端を積層して抵抗溶接若しくは超音波溶接することにより、又ははとめをかしめることにより若しくははんだ付けすることにより正極及び負極端子２１，２３の各他端を接着し、このように接着された正極及び負極端子２１，２３の各他端を電池の端子として使用することにより所望の電気を得るように構成される。

【００２７】このように構成されたリチウムイオンポリマー二次電池１０では、複数の正極集電体箔１２の一方の端部１２ｂを積層順に複数組に分け、その組数に応じた複数の正極端子２１の各一端を組毎に積層された正極集電体箔１２の一方の端部１２ｂの間に挿入してその一方の端部１２ｂに接続し、複数の負極集電体箔１５の他方の端部１５ａを積層順に複数組に分け、その組数に応じた複数の負極端子２１の各一端を組毎に積層した負極集電体箔１５の他方の端部１５ａの間に挿入してその他方の端部１５ａに接続したので、端子２１，２３の数を増加させるだけでその断面積を拡大することが可能になり、増大させた放電容量に応じた端子の断面積を比較的容易に得ることができ、厚さの比較的厚い単一の端子を接続する場合に比較して比較的湾曲させやすい二次電池を得ることができる。

【００２８】また、正極端子２３の一端は複数の正極集電体箔１２の積層順に複数組に分けられて積層された各組の一方の端部１２ｂの間に挿入され、負極端子２１の

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一端は複数の負極集電体箔１５の積層順に複数組に分けられて積層された各組の積層された他方の端部１５ａの間に挿入されるので、二次電池１０を繰り返し湾曲させても、正極端子２３とその正極端子２３を挟む正極集電体箔１２の間に、又は負極端子２１とその負極端子２１を挟む負極集電体箔１５の間に隙間が生じることはなく、その接触部分における導電性は確保され、端子接合部における抵抗を十分に低減することができる。

【００２９】また、複数の正極集電体箔１２の一方の端部１２ｂ及び複数の負極集電体箔１５の他方の端部１５ａと正極端子２３及び負極端子２１との接続が、所定の間隔ｔをあけてかしめられた複数のはとめ２５により行われるので、積層された端部の全ての部分を接合する場合に比較して機械的強度の上昇を抑制することができ、シート状の二次電池１０が従来から有するフレキシブル性を確保することができる。更に、正極集電体箔１２の積層された一方の端部１２ｂの積層外面に補強箔又は補強薄板２４を配置し、負極集電体箔１５の積層された他方の端部１５ａの積層外面に補強箔又は補強薄板２２を配置したので、二次電池１０を湾曲させた場合の、外側における正極集電体箔１２及び負極集電体箔１５のかしめ箇所における亀裂等の破損を防止でき、二次電池１０の信頼性を向上させることができる。

【００３０】なお、上述した実施の形態では、所定のピッチで複数の正極シート１１が熱圧着された帯状の負極シート１４を、正極シート１１が配置されていない折目で交互に折曲げたが、正極シートと同形同大の複数の負極シートを正極シートと同じ数用意し、正極活物質と負極活物質との間にそれぞれポリマー電解質層を介在させ、それらのシートを構成する複数の正極集電体箔と複数の負極集電体箔とを積層したものであっても良い。

【００３１】また、上述した実施の形態では、複数のはとめ２５により端子２１，２３の各一端を正極集電体箔１２の一方の端部１２ｂ又は負極集電体箔１５の他方の端部１５ａに接続したが、複数の正極端子２３の各一端が組毎に積層された正極集電体箔１２の一方の端部１２ｂの間に挿入された状態で挿入方向と交差する方向に所定の間隔ｔをあけて複数箇所超音波溶接することにより正極端子２３の各一端を複数の正極集電体箔１２の一方の端部１２ｂに接続し、複数の負極端子２１の各一端が組毎に積層された負極集電体箔１５の他方の端部１５ａの間に挿入された状態で挿入方向と交差する方向に所定の間隔ｔをあけて複数箇所超音波溶接することにより負極端子２１の各一端を複数の負極集電体箔１５の他方の端部１５ａに接続しても良い。超音波溶接により接続した場合、はとめ２５を用いて接続する際に必要とされた貫通孔２７を形成する手間を省くことができるとともに、積層された端部１２ａ，１５ｂの全ての部分を接合する場合に比較して機械的強度の上昇を抑制することができてそのフレキシブル性を確保することができる。

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【００３２】

【発明の効果】以上述べたように、本発明によれば、複数の正極集電体箔の一方の端部を積層順に複数組に分け、組数に応じた複数の正極端子の各一端を組毎に積層された正極集電体箔の一方の端部の間に挿入して正極集電体箔の一方の端部に接続し、複数の負極集電体箔の他方の端部を積層順に複数組に分け、組数に応じた複数の負極端子の各一端を組毎に積層された負極集電体箔の他方の端部の間に挿入して負極集電体箔の他方の端部に接続し、パッケージが複数の正極端子の各他端と複数の負極端子の各他端とを個別に表出し得る組数に応じた数の端子取出口を有し、かつ複数の正極端子の各他端及び複数の負極端子の各他端がそれぞれ積層されて接着可能に構成したので、端子の数を増加させるだけでその断面積を拡大することが可能になり、増大させた放電容量に応じた端子の断面積を比較的容易に得ることができ、また、厚さの比較的厚い単一の端子を接続する場合に比較して比較的湾曲させやすい二次電池を得ることができる。

【００３３】また、正極端子の一端は複数の正極集電体箔の組毎に積層された一方の端部の間に挿入され、負極端子の一端は複数の負極集電体箔の組毎に積層された他方の端部の間に挿入されるので、二次電池を繰り返し湾曲させても、正極端子とその正極端子を挟む正極集電体箔の間に、又は負極端子とその負極端子を挟む負極集電体箔の間に隙間が生じることはなく、その接触部分における導電性は確保され、端子接合部における抵抗を十分に低減することができる。更に、複数の正極集電体箔の一方の端部及び複数の負極集電体箔の他方の端部をそれぞれ組毎に積層して、その組数に応じた正極端子及び負極端子を接続するが、その接続は、所定の間隔をあけてかしめられた複数のはとめにより又は複数箇所超音波溶接することにより行えば、積層された端部の全ての部分を接合する場合に比較して機械的強度の上昇を抑制することができ、シート状の二次電池１０が従来から有するフレキシブル性を確保することができる。

【図面の簡単な説明】

【図１】本発明の二次電池を示す図５のＢ－Ｂ線断面図。

【図２】その正極及び負極シートが積層され端子が接続された積層体を示す斜視図。

【図３】その積層体がパッケージにより密封された本発明の二次電池を示す斜視図。

【図４】そのはとめをかしめる手順を示す断面図。

【図５】その二次電池を示す図１のＡ－Ａ線断面図。

【図６】その二次電池の構成を示す分解斜視図。

【図７】その負極シートに正極シートが熱圧着される状態を示す斜視図。

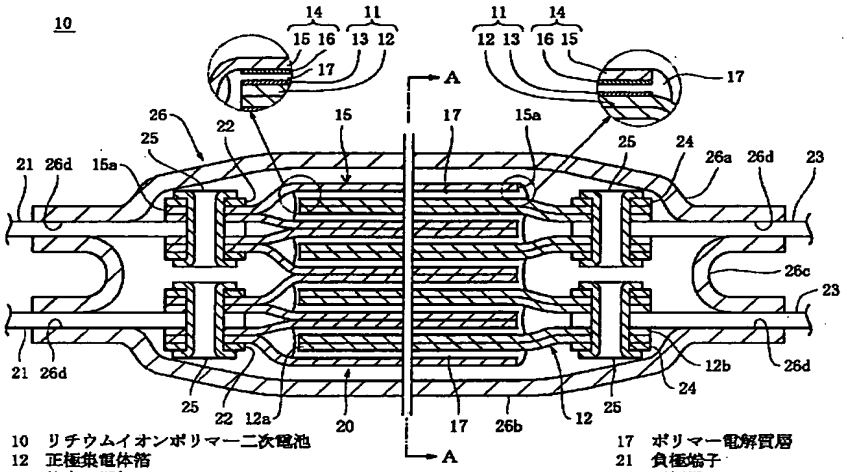
【図８】その正極シートの製造工程を示す図。

【図９】その負極シートの製造工程を示す図。

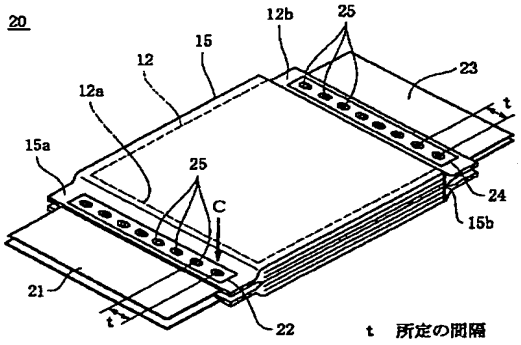
【符号の説明】

１０　リチウムイオンポリマー二次電池
１２　正極集電体箔
１２ａ　他方の端部
１２ｂ　一方の端部
１３　正極活物質
１５　負極集電体箔
１５ａ　他方の端部
１５ｂ　一方の端部
１６　負極活物質
１７　ポリマー電解質層
２１　負極端子
２２　補強箔又は補強薄板
２３　正極端子
２４　補強箔又は補強薄板
２５　はとめ
２６　パッケージ
２６ｄ　端子取出口
ｔ　　所定の間隔

【図１】



【図２】



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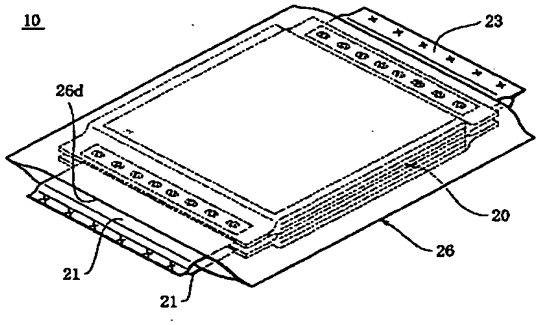

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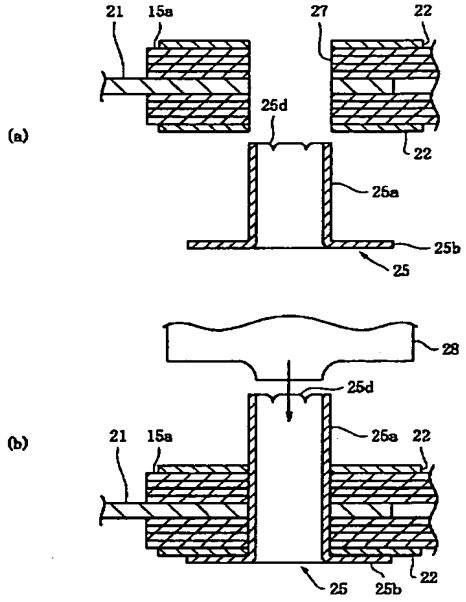
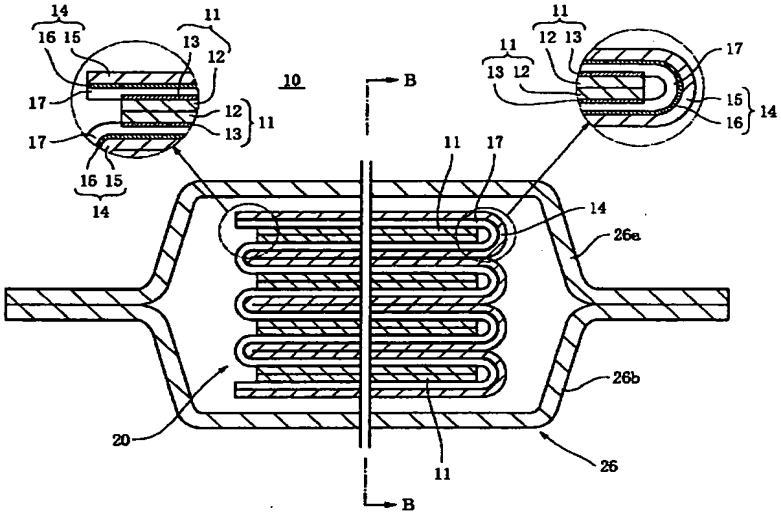
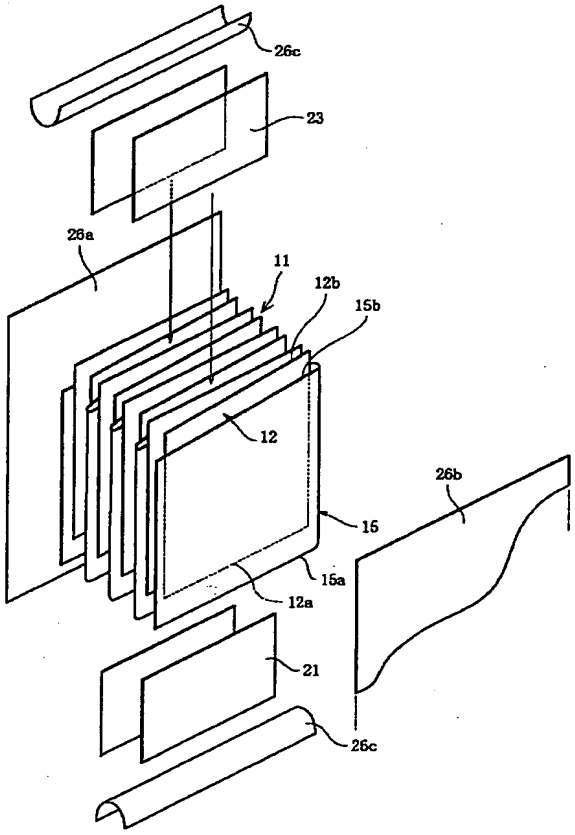

(a)
21
15a
27
22
25d
22
25a
25b
25
(b)
28
25d
21
15a
25a
22
25
25b
22
(c)
21
15a
25c
22
25a
25
25b
22

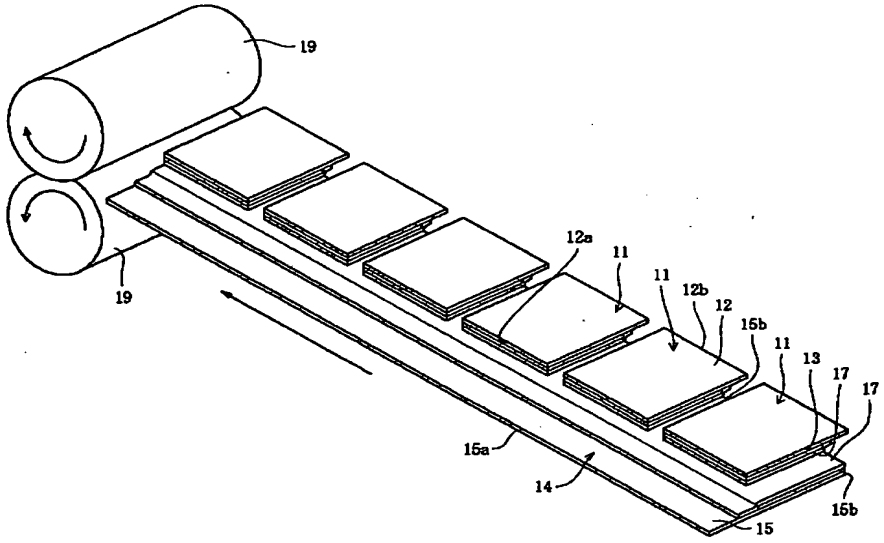
【図５】


14
16 15
11
13
12
17
12
13
11
17
16 15
14
10
B
11
12 13
17
11
13 12
15
16
14
11
17
14
26a
26b
20
11
26
B

【図６】


26c
23
26a
11
12b
15b
12
26b
15
15a
12a
21
26c

【図7】


19
19
12a
11
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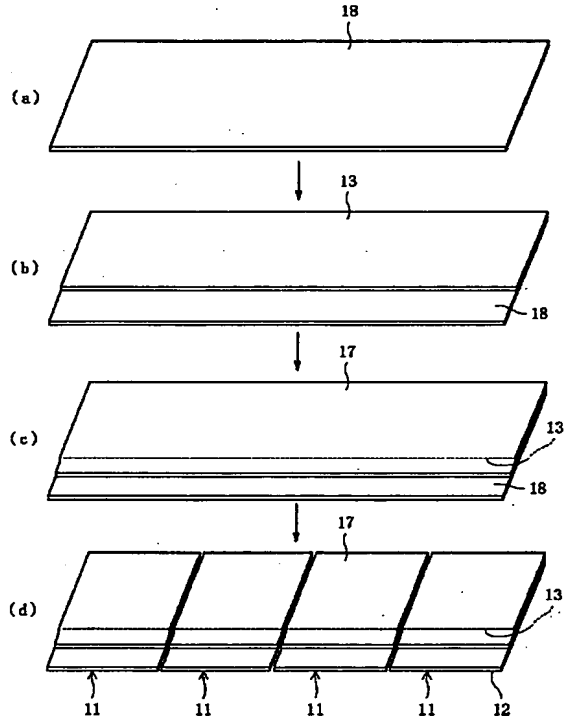
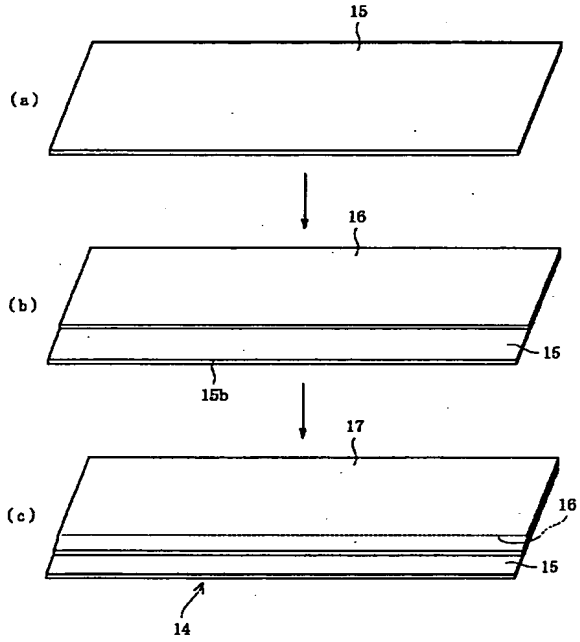
12b
12
15b
11
13
17
17
15a
14
15b
15

【図8】


18
(a)
13
(b)
18
17
(c)
13
18
17
(d)
13
11
11
11
11
12

【図9】


15
(a)
16
(b)
15
15b
17
(c)
16
15
14

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